CLAIMS

What is claimed is:

1. A separator of a fuel cell, the separator comprising a solid-state, amorphous alloy.

2. The separator of claim 1, which has a corrosion rate approximately less than or equal to 20 μA/cm^2 in a hydrogen-saturated solution having a temperature of 130°C and a pH of 3.

3. The separator of claim 1, wherein the solid-state, amorphous alloy has a fracture toughness of greater than or equal to 5 (ksi)-(in$^{1/2}$).

4. The separator of claim 1, wherein the solid-state, amorphous alloy has an elastic limit greater than or equal to 1% .

5. The separator of claim 1, wherein the solid-state, amorphous alloy has a composition represented by the formula, $(Zr, Ga)_a(Ti, P, W)_b(V, Nb, Cr, Hf, Mo, C)_c(Ni)_d(Cu)_e(Fe, Co, Mn, Ru, Ag, Pd)_f(Be, Si, B)_g(Al)_h$, where a+b+c is 15 to 75 atomic%, d+e+f is 5 to 75 atomic%, and g+h is 0 to 50 atomic%, provided that a+b+c+d+e+f+g+h is 100 atomic%.

6. The separator of claim 5, wherein the solid-state, amorphous alloy has a composition of $Zr_{41}Ti_{14}Ni_{10}Cu_{12.5}Be_{22.5}$.

7. The separator of claim 5, wherein the solid-state, amorphous alloy has a composition of one of: $Fe_{72}Al_5Ga_2P_{11}C_6B_4$ and $Fe_{72}Al_7Zr_{10}Mo_5W_2B_{15}$.

8. A fuel cell, comprising:

an anode;

a cathode;

an electrolyte membrane disposed between the anode and the cathode, being on a first side of the anode and the cathode; and

at least one separator proximate to one of: the anode and the cathode, the separator being disposed on a side of the anode/cathode opposite to the electrolyte membrane, and comprising a solid-state, amorphous alloy.

9. The fuel cell of claim 8, wherein the at least one separator has a corrosion rate less than or equal to 20 $\mu A/cm^2$ in a hydrogen-saturated solution having a temperature of 130°C and a pH of 3.

10. The fuel cell of claim 8, wherein the solid-state amorphous alloy has a fracture toughness of greater than or equal to 5 (ksi)-($in^{1/2}$).

11. The fuel cell of claim 8, wherein the solid-state, amorphous alloy has an elastic limit greater than or equal to 1%.

12. The fuel cell of claim 8, wherein the solid-state, amorphous alloy has a composition represented by the formula, $(Zr, Ga)_a(Ti, P, W)_b(V, Nb, Cr, Hf, Mo, C)_c(Ni)_d(Cu)_e(Fe, Co, Mn, Ru, Ag, Pd)_f(Be, Si, B)_g(Al)_h$, where a+b+c is 15 to 75 atomic%, d+e+f is 5 to 75 atomic%, and g+h is 0 to 50 atomic%, provided that a+b+c+d+e+f+g+h is 100 atomic%.

13. The fuel cell of claim 12, wherein the solid-state, amorphous alloy has a composition of $Zr_{41}Ti_{14}Ni_{10}Cu_{12.5}Be_{22.5}$.

14. The fuel cell of claim 12, wherein the amorphous alloy has a composition of one of: $Fe_{72}Al_5Ga_2P_{11}C_6B_4$ and $Fe_{72}Al_7Zr_{10}Mo_5W_2B_{15}$.

15. A method of manufacturing a separator of a fuel cell, the separator comprising a solid-state, amorphous alloy, the method comprising:

preparing a melt to transform the solid-state, amorphous alloy;

feeding the melt into a mold provided with a mold cavity having a shape corresponding to the separator; and

cooling the melt In the mold cavity at a cooling rate higher than a critical cooling rate to transform the melt into an amorphous phase.

16. The method of claim 15, wherein the solid-state, amorphous alloy has a corrosion rate less than or equal to 20 $\mu A/cm^2$ in a hydrogen-saturated solution having a temperature of 130°C and a pH of 3.

17. The method of claim 15, wherein the solid-state, amorphous alloy has a fracture toughness greater than or equal to 5 (ksi)-($in^{1/2}$).

18. The method of claim 15, wherein the solid-state, amorphous alloy has an elastic limit greater than or equal to 1%.

19. The method of claim 15, wherein the solid-state, amorphous alloy has a composition represented by the formula, $(Zr, Ga)_a(Ti, P, W)_b(V, Nb, Cr, Hf, Mo, C)_c(Ni)_d(Cu)_e(Fe, Co, Mn, Ru, Ag, Pd)_f(Be, Si, B)_g(Al)_h$, where a+b+c is 15 to 75 atomic%, d+e+f is 5 to 75 atomic%, and g+h is 0 to 50 atomic%, provided that a+b+c+d+e+f+g+h is 100 atomic%.

20. The method of claim 19, wherein the solid-state, amorphous alloy has a composition of one of: $Zr_{41}Ti_{14}Ni_{10}Cu_{12.5}Be_{22.5}$, $Fe_{72}Al_5Ga_2P_{11}C_6B_4$ and $Fe_{72}Al_7Zr_{10}Mo_5W_2B_{15}$.